

NPS/CIRPAS Activity Summary

Activity Name

Kernel Blitz 2001(KB01)

Customer(s)

Office of Naval Research (ONR)

Program Description

KB01 is a CINCPAC-sponsored training exercise involving 3DFLT and I MEF forces. The exercise will simulate reestablishing freedom of navigation through the Straits of Catalina and clearing a conventional amphibious operating area in support of 1st MEB operations. NPS/CIRPAS supported the Office of Naval Research (ONR), the Naval Surface Warfare Center (NSWC) and the Navy's Post Graduate School during KB01 by providing payload integration, an airborne platform and crew for Areté Associates' Airborne Remote Optical Spotlight



System (AROSS). The experiment took place off the coast of southern California near Camp Pendleton and La Jolla, CA in the Kernel Blitz area of operations. Areté provided AROSS operators, analysts and engineers to support flight operations, conduct data collection, provide data analysis and produce Mine-Like Object (MLO) detection and Meteorological, Oceanographic (METOC) products. Real-time transmission of AROSS imagery and metadata was achieved through a collaboration with NSWC. The objective for the Kernel Blitz support was to demonstrate timely response to Fleet MLO and METOC requirements for mine countermeasures and battlespace characterization in support of Ship to Objective Maneuver amphibious operations.

The Kernel Blitz 01 deployment to McClellan-Palomar Airport in Carlsbad, CA occurred 16 – 31 March 2001.

Asset Description

The Pelican

The Pelican is a long-endurance aircraft designed to support low-altitude, atmospheric and oceanographic research and development activities. The vehicle is a highly modified Cessna 337 Skymaster with the forward engine eliminated. CIRPAS has two Pelican aircraft based at the Marina, CA facility. Pelican 11155 (also referred to as Pelican II) was flown in support of FBE-H. Characteristics of Pelican include:

- *Surrogate Predator UAV (Pelican I only)*
- *Distributed Real-Time Data Access*
- *Large Payload (150kg nose, additional in cabin and on wings)*
- *1.2kW Payload Power*

- *Diverse Payload (chemistry, meteorology, oceanography, remote sensing, etc.)*
- *Long Duration (in excess of 12 hrs)*
- *Speed Range of 80-130 KIAS*

The Payload

Arete's AROSS payload was integrated to Pelican II at the CIRPAS Marina, CA facility and ferried to McClellan-Palomar Airport, Carlsbad, CA. The AROSS system is an R&D surrogate for future UAV-based optical imaging systems. It is designed to provide time series of ocean images -- much like a video but with superior resolution -- which are then mapped to earth coordinates. This enables sophisticated space/time processing for multiple purposes. The primary goals for KB01 were to foster transition of ONR



developed technology to the fleet, further evaluation of LRS METOC retrieval and mine detection algorithms, initial evaluation of Beach and BEZ Characterization algorithms and Exhibit ISR capability across National, Theater, and Organic assets.

The sensor is mounted in a 14-inch WESCAM gimbal turret and integrated to the CIRPAS Pelican aircraft as a UAV surrogate. The majority of the payload electronics are located in the nose payload bay. The remainder of payload subsystems are integrated to the rack behind the pilot/payload operator in the cabin. The Skyball turret is guided using the aircraft's (differential) GPS location and inertial sensors to stare at or spotlight another GPS location on the ocean (or land, if desired).

Three operational modes:

1. *Orbital Spotlight -- circles around target, provides all azimuths with long dwell*
2. *Flyby Spotlight -- militarily interesting with moderate dwell (1-2 minutes)*
3. *Flyby Strip map -- militarily interesting with less dwell (45 seconds at tactical UAV speeds)*

Data recorded on 54 GB RAID total 3½ hours data at 2 Hz sampling rate.

Nominal range to target is 6 km and altitude is 10 kft. This provides 2 m spatial resolution with 2 km by 2 km footprint.

Flight Activity Description

The Pelican aircraft with the AROSS payload arrived at McClellan Palomar Airport on 17 March 2001. Mission flights were flown from 18 March to 31 March 2001. CIRPAS flew up to two four hour missions each day, at altitudes of 2,5000 to 10,000 feet. Flights were conducted in two areas along the shoreline near Camp Pendleton, CA and La Jolla, CA. Data collected by AROSS was analyzed for small surface and near-surface object detection for the locations of interest. The MLO product produced for the fleet command was high quality, spatially registered digital video imagery with jpeg images of MLO detections displayed and marked. Specific objectives of the AROSS program were to detect and locate near-surface PDM-3 surrogate mines in near-real time using AROSS imagery; geo-locate beach defenses and other identified land targets; and provide demonstration of beach characterization techniques. METOC collections were also analyzed. The METOC product consisted of a bathymetry line chart depicting the

areas of interest. The chart consisted of a 2km by 2km area and displayed bathymetry from the shoreline through the surf and over the Very Shallow Water (VSW) range of interest. In addition, the METOC product provided imagery of near-shore wave processes.

The Acoustic Radio Interactive Exploratory Sensor (ARIES) AUV is under development as a communications server vehicle. The vehicle is an outgrowth of the NPS Phoenix AUV, which has been used as a test bed for AUV control systems and Command and Control research. When



equipped with an underwater video camera, it may be used as a reacquisition and ID vehicle for mine like contacts. When ARIES surfaces, it both corrects navigational error and acts as a communications server for file transfer and underwater vehicle redirect. Pelican was able to extend the range of the AUV from its base station by providing an onboard relay during KB01.

CIRPAS flew 62 hours in support of KB01.

Both the AROSS and ARIES systems were highlighted in the U.S. Third Fleet's Joint Information Bureau News Release on 26 March 2001...

March 26, 2001

FOR IMMEDIATE RELEASE

Let the robots do the dangerous work

The United States Navy and Marine Corps increasingly must accomplish expeditionary missions in which they operate in the littorals—in the sea and on the land along the shore. These missions require a very different set of capabilities from those needed in blue-water fleet operations. In particular, the threats they will face include many “asymmetric threats”—threats like mines. The Navy and Marine Corps are using advanced science and technology to meet and overcome the mine threat.

In conjunction with Exercise Kernel Blitz 01, the Office of Naval Research is sponsoring demonstrations of advanced mine countermeasures systems off the beaches of Camp Pendleton, CA, on 16 March 2001. These systems represent advanced science and technology being developed to detect, identify, and classify mines in shallow and very shallow waters. They exploit recent advances in sensors (especially lasers, sonar, and television-like imaging), robotics (the sensors are installed on a variety of autonomous underwater vehicles—submarine robots), networking, and signal processing. Developed by teams of government, industry, and academic partners, the mine countermeasures technologies offer the prospect of ultimately reducing or eliminating the need for Sailors and Marines to enter the dangerous shallow waters just off shore in order to clear mines in preparation for expeditionary operations.

The systems and their developers will be available to the press this Friday, 16 March 2001, from 9:00 AM to 12:00 noon, at the Army Reserve Center, Building 210545, 21 Area, Del Mar Boat Basin, Marine Corps Base, Camp Pendleton, California. In addition to scientists, engineers, and military personnel from the United States, allies from Canada, Singapore, and the United Kingdom are also participating in this demonstration. Systems on display include:

- Acoustic Radio Interactive Exploratory Sensor (ARIES). Developed and built by the Naval Postgraduate School (Monterey, California), ARIES is mobile, robotic, digital communications server that links underwater systems with airborne systems and surface ships.
- Airborne Remote Optical Spotlighting System (AROSS). Developed and built by Areté Associates, AROSS is an airborne digital camera designed to be mounted in a pilotless aircraft like the Navy and Marine Corps Predator Uninhabited Air Vehicle. It provides pictures of areas of interest and transmits them to commanders for their use in identifying hazards, determining currents and waves, and targeting. AROSS incorporates powerful algorithms that enable a battle staff to retrieve information readily and usefully from a large database of images.
- Battlespace Preparation Autonomous Underwater Vehicle (BPAUV). Developed and built by Bluefin Robotics (Cambridge, Massachusetts), BPAUV is a small, fast underwater robot that maps the ocean bottom near the shore, detects changes in inshore conditions, and hunts mines.
- CETUS II. Built by Lockheed Martin's Perry Technologies with the collaboration of Naval Sea Systems Command's Explosive Ordnance Disposal Technology Division, CETUS II is a low-cost robotic underwater vehicle designed to locate, detect, classify, and identify mines in shallow waters (from 33 to 525 feet). CETUS is small and light—easily handled by two people—and capable of hovering and other precise underwater movements.
- Expeditionary Warfare Decision Support System (EDSS). This advanced software package, developed by Science Applications International Corporation, is designed to help commanders make sound, timely decisions during amphibious missions.
- Summus Sonar Juggler. Summus Ltd.'s Sonar Juggler is side-scan sonar image processing software. It's intended to help the US Navy build comprehensive seafloor characterization databases and high resolution mapping for mine countermeasure missions.
- Littoral Airborne Sensor Hyperspectral (LASH). Science and Technology International have developed LASH as an airborne sensor that can see targets quickly in shallow waters. Like AROSS, LASH is intended for installation aboard an uninhabited air vehicle.
- Tactical Decision Aids for Autonomous Underwater Vehicles. Developed by the Naval Postgraduate School, this software package runs on a laptop and displays data from autonomous underwater vehicles operating in the area.

- Morpheus. Morpheus is an autonomous underwater vehicle developed by Florida Atlantic University. It uses acoustic and visible light sensors to detect mines.
- Moving Map. A collaborative project of Harris and the Naval Research Laboratory, the Moving Map is designed for installation in the cockpits of aircraft participating in mine countermeasures operations.
- Ocean Explorer. Developed by Florida Atlantic University, the Ocean Explorer is an autonomous underwater vehicle that can be rapidly reconfigured for a variety of specialized mine detection missions. Its sensor payloads can be easily and swiftly changed at sea.
- Remote Environmental Monitoring System (REMUS). Woods Hole Oceanographic Institution's successful REMUS is being adapted to mine hunting and hydrographic reconnaissance for Naval Sea Systems Command and the US Special Operations Command. REMUS can operate from the seaward edge of the surf into waters as deep as 100 meters.
- Video Imaging System for Surf-Zone Environmental Reconnaissance (VISSER). The Naval Research Laboratory's VISSER images the environment in the surf zone.
- SEE-TRAK. Developed by SeeByte Ltd. and Heriot-Watt University (Edinburgh, Scotland), SEE-TRAK's unique capabilities earned it a special invitation to participate in the demonstration. It provides on-site visualization, analysis, and data fusion of sonar and video images.

The Office of Naval Research pursues an integrated science and technology program from basic research through manufacturing technologies. Research areas include oceanography; advanced materials; sensors; electronics; surveillance; mine countermeasures; weapons; and surface ship, submarine and aircraft technologies. For more information about ONR programs, refer to the ONR home page at <http://www.onr.navy.mil> on the World Wide Web.

Interested media should contact the U.S. Third Fleet Public Affairs Office at (619) 524-9562 or via e-mail at c3fpao@coronado.navy.mil